

## REMARKS

### **In the Specification**

Paragraphs [0009], [0035] and [0067] have been amended to correct minor typographical errors.

The phrase "What is claimed is:" has been added immediately prior to the listing of the claims so that the Application comports with standard USPTO practice.

### **In the Claims**

Claims 1–13 are pending in the application and stand rejected for the reasons discussed below.

### **Claim rejections under 35 USC §101**

Claims 1–13 stand rejected under 35 USC §101 as directed to non-statutory subject matter of software *per se*.

Applicant respectfully traverses this rejection.

The recent case of *In Re Bilski*, 545 F.3d 943 (CAFC 2008) addressed the issue of what constitutes statutory subject matter under 35 USC §101 for process claims. The court in *In Re Bilski* set forth a two-part test that reads as follows (emphasis added): "an applicant may show that a process claim satisfies §101 either by showing that his claim is tied to a particular machine, or by showing that his claim transforms an article." *In Re Bilski* 545 F.3d at 961. Note that only one of these two conditions needs to be met in order to satisfy the test.

The preamble to Applicants' Claim 1 reads as follow (emphasis added):

A method of establishing timing for first and second modulators in a quantum key distribution (QKD) system, comprising:

Independent Claims 9 and 11 have similar preambles.

Clearly, Claims 1, 9 and 11 are tied to a particular machine—namely, a QKD system. The various acts in the claims define a way of establishing timing of first and second modulators in the QKD system (i.e., the “machine”) using “modulator activation signals,” “exchanged non-quantum signals” and “detector counts.” The established modulator timing is a **physical result** based on the operation of components of the QKD “machine.”

The Examiner asserts that the claimed process can be carried out “mentally.” This is clearly erroneous, as the timing issues of a QKD system are far too complex and require the actual operation of the QKD “machine” to exchange the non-quantum signals, set the modulations and detect the non-quantum signals in order to place the system in a condition that allows for the QKD system to operate at or near its optimal operating state. Citing one simple example, one cannot “mentally” generate and detect the non-quantum signals to establish the QKD system performance.

Further claims 1, 9 and 11 result in a “transformed article,” which in the present instance is the QKD system itself. Prior to performing the claimed invention, the QKD system understood as not having its modulator timing properly established and is not at or near its optimum operating condition (see, e.g., Applicant’s Published Application, paragraphs [0027]–[0031]). After performing the claimed invention, the QKD system operates at or near its optimal operating state. Thus, the claimed invention transforms the QKD “machine” from a non-ideal operating state to an ideal or near-ideal operating state.

Applicants respectfully submit that in view of the above, claims 1, 9 and 11, and the respective claims depending therefrom, are unmistakably directed to statutory subject matter under 35 USC §101 because they clearly satisfy at least one of the two requirements of the two-part test of *In Re Bilski* for determining whether a process claim is directed to statutory subject matter.

Applicant therefore traverses the rejection of claims 1–13 under 35 USC §101 and respectfully requests withdrawal of the rejection.

### Claim rejections under 35 USC §103

Claims 1–13 stand rejected under 35 USC § 103(a) based on U.S. Patent No. 7,606,371 to Zavriyev et al. (“Zavriyev”) in view of U.S. Patent No. 5,515,438 to Bennett (“Bennett”).

#### I. The law regarding obviousness rejections

A rejection based on obviousness requires that the Examiner make out a *prima facie* case, “without which the applicant is entitled to grant of the patent.” (see, e g., *In re Oeticker*, 24 USPQ 2d 1442, 1444 (Fed. Cir. 1992)).

As stated in MPEP § 706.02 (j), a *prima facie* case of obviousness requires:

- (1) some suggestion or motivation to modify the references;
- (2) a reasonable expectation of success; and
- (3) the references when combined must teach or suggest all the claimed limitations.

Making out a *prima facie* case involves conducting a factual inquiry based on the so-called “Graham Factors” recently re-enunciated by the Supreme Court in *KSR International Co. v. Teleflex, Inc.*, 82 USPQ2d 1385, 1391 (2007), and as discussed in MPEP § 2141.

The Graham Factors are:

- a) ascertaining the scope and content of the prior art;
- b) ascertaining the differences between the claimed invention and the prior art; and
- c) resolving the level of ordinary skill in the pertinent art.

In determining the differences between the prior art and the claims, the question under 35 USC §103 is not whether the differences themselves would have been obvious, but whether *the claimed invention as a whole* would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1537 (MPEP 2141.02(l) (emphasis added)).

Applicant respectfully submits that the Examiner is adopting an overly expansive and fundamentally mistaken view of the scope and content of the cited art, and fails to read Applicant’s claims as a whole, thereby arriving at an

erroneous conclusion of obviousness.

### Claims 1-10

By way of review, Zavriyev discloses a two-way QKD system having first and second QKD stations. The QKD system is configured to actively compensate for temperature drifts, which can cause phase shifts that in turn can diminish interference of the quantum signals (col.2, lines 18-25) exchanged between the two QKD stations.

Zavriyev achieves active compensation by the first QKD station having at least first and second interferometer loops and sending control signals from the first to the second loop without transmitting the control signals to the second QKD station. The two interferometer loops give rise to two interfered controlled signals I1 and I2, which are detected. The ratio I1/I2 is maintained constant by adjusting the phase of one arm of the second interferometer using a phase shifter PSB2 (see, e.g., col. 2, lines 42-55; FIGS. 1, 6).

The phase modulators PMA and PMB1 are used to impart phases to the quantum signals, while the phase shifter PSB2 is used to adjust the phase to provide the active compensation for phase errors that manifest themselves as variations in the ratio I1/I2. See, e.g., col. 6, line 21 to column 9, line 35.

The Examiner points to the Abstract for disclosing that a "fixed relationship/modulation is maintained between modulated signals." The Abstract of Zavriyev is reproduced below:

(57)

#### **ABSTRACT**

A two-way actively stabilized QKD system that utilizes control signals and quantum signals is disclosed. Because the quantum signals do not traverse the same optical path through the system, signal collisions in the phase modulator are avoided. This allows the system to have a higher transmission rate than a two-way system in which the quantum signals traverse the same optical path. Also, the active stabilization process, which is based on maintaining a fixed relationship between an intensity ratio of interfered control signals, is greatly simplified by having the interferometer loops located all in one QKD station.

As can be seen from the Abstract and a close reading of the description of the operation of the QKD system as described in the Application (and as summarized above), the “fixed relationship” relates to the intensity ratio  $I_1/I_2$  of the interfered control signals. This “fixed relationship” is obtained by adjusting the phase in one arm of the second interferometer using phase shifter PSB2 to control the phase of the optical path, and has nothing to do with the timing of modulators PMA and PMB1 used to impart respective phases to the quantum signals.

Applicant respectfully submits that a closer reading of Zavriyev reveals that Zavriyev does not include any disclosure or information relating to establishing the timing for the first and second modulators, including setting the first and second modulators to a fixed modulation and incrementally scanning modulator activation signals while transmitting non-quantum (optical) signals in the process of establishing modulator timing

The Examiner points to Bennett (col. 6, lines 4–20 and FIG. 1) for disclosing the claim limitations relating to the incremental scanning of the activation signals for the first and second modulators. However, a close reading of Bennett quickly reveals that the cited text therein has nothing to do with establishing modulator timing using incremental scanning. Rather, as described in the preceding and subsequent paragraphs to the cited text, the cited text refers to a method of making estimates of the raw key from pairs of coherent light pulses in respective R and S sub-channels.

The reason why Bennett does not disclose any information relating to establishing the timing between two modulators in a QKD system is because Bennett only uses a single modulator—namely, element (5) in FIG. 1. Therefore, there is absolutely no need in Bennett to establish timing between two modulators. The QKD system of Bennett operates at its receiving end without a modulator, making Bennett entirely inapplicable to Applicant’s invention. Consequently, one skilled in the art would never look to Bennett when considering ways to establish the timing between two modulators.

The above discussion is general to the independent claims 1 and 9 and so covers these claims, as well as their respective dependent claims.

Because the basic rejection of the claims relies on Zavriyev and Bennett, Applicant traverses the obviousness rejection to claims 1–10 because these cited references, when combined, do not teach all of the claim limitations in each of Applicant’s independent claims.

Applicant therefore respectfully requests that the obviousness rejection for these claims be withdrawn.

### Claims 11–13

Claims 11–13 stand rejected based on Bennett in view of the article by Merrolla entitled “Integrated quantum key distribution system using single sideband detection” (“Merrolla”)

Applicant needs not address the content of the disclosure of Merrolla because the rejection relies on the erroneous belief that Bennett discloses information about the claim limitations relating to the activation signal widths. However, the cited text in Bennett relates not to modulator activation electronic signals but rather to non-orthogonal optical signals, which have absolutely nothing to do with system timing.

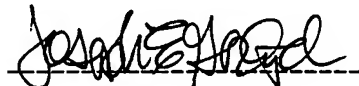
Further, as discussed above, the QKD system of Bennett only has one modulator, so that Bennett has nothing to do with establishing the timing between two modulators using modulator activation signals.

Consequently, the combination of Merrolla and Bennett cannot reasonably be said to disclose all of the limitations in Applicant’s claim 11 and therefore claims 12 and 13 depending therefrom. Applicants therefore traverse the rejection of claims 11–13 and respectfully request the withdrawal of the rejection.

### CONCLUSION

Applicant respectfully submits that claims 1-13 constitute statutory subject matter under 35 USC § 101, and that the claims are patentable over the cited references. Accordingly, Applicant respectfully requests the withdrawal of the rejections under 35 USC § 101 and 35 USC § 103 and a Notice of Allowance for the pending claims.

The Examiner is encouraged to contact Applicant's undersigned attorney in connection any issues that may arise in connection with the examination of the present Application.



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